

NOVA Chemicals

PROCESSING EPS

Processing of Expandable Polystyrene (EPS) Resins

The foam that is produced from expandable polystyrene resins is closed-cell, lightweight, and rigid which makes it suitable for a variety of applications. The process of converting EPS resins into expanded polystyrene foam articles requires three main stages: Pre-expansion, Maturation and Molding.

The purpose of pre-expansion is to produce foam particles (prepuff) of the desired density for a specific application. During pre-expansion, the EPS beads are fed to a vessel containing an agitator and controlled steam and air supplies (this vessel is called a pre-expander).

The introduction of steam into the pre-expander yields two effects:

- the EPS beads soften
- the blowing agent (pentane) that is dispersed within the EPS beads heats to a temperature above its boiling point

These two conditions cause the EPS beads to expand in volume. The diameter of the particles increases while the density of the resin decreases. Adjustments to pre-expansion conditions (residence time, temperature, resin feed rate, etc.) allow the user to achieve different prepuff densities as dictated by the end-use application.

Upon exiting the pre-expander, the prepuff may flow through a dryer to remove moisture or may flow directly to a maturation, or aging, silo.

Maturation serves several purposes:

- Allows the vacuum that was created within the cells of the foam particles during pre-expansion to reach equilibrium with the surrounding atmospheric pressure
- Permits residual moisture on the surface of the prepuff to evaporate
- Provides for the dissipation of excess residual blowing agent (in high-density foam applications)

Maturation time depends on numerous factors, including, but not limited to: blowing agent content of the original resin, pre-expanded density, environmental factors (ambient temperature, humidity, etc.) Prepuff that is “fresh” (i.e., not properly matured) is very sensitive to physical and thermal shock. Molding of fresh prepuff may cause the cells within the particles to rupture, thereby producing an undesirable molded foam part.

Once the prepuff has properly matured, it is transferred to a molding machine containing one or more cavities that are

shaped like the desired molded foam article(s). The purpose of molding is to fuse the foam particles together in to a single foam part that meets the requirements. Molding of EPS prepuff may follow numerous variations on the following simple sequence:

- Fill the mold cavity with prepuff
- Heat the prepuff by introducing steam
- Cool the molded foam article within the mold cavity
- Eject the finished part from the mold cavity

The steam that is introduced to the molding machine causes the prepuff to soften and expand even further. The combination of these two effects in an enclosed cavity allows the individual particles to fuse together into a single solid foam part. Cooling of the foam part via vacuum or cooling water allows the foam to stiffen and reduce its internal pressure. This will ensure that the part is dimensionally stable once it is ejected from the mold cavity.

Additional finishing operations, such as hot-wire cutting, embossing, printing, laminating, etc., can be used to customize the final molded product.

